Communications

Circuit/Mechanical Descriptions

The Uroview 2800 is a complex multiprocessor-based Subsystem that depends on signals from an external controller to operate. Simply put, it is not a stand-alone X-ray system. The OEC WorkStation is the only compatible external controller.

The Uroview Subsystem chapter in this manual provides a brief summary and block diagram of Subsystem communications.

This chapter provides more detail on ARCNet functions and the CAN Bus, and explains the other significant interfaces used in Subsystem communications.

The ARCNet

The Uroview 2800's ARCNet is a very compact one by most standards. The network consists of the following nodes:

- **WorkStation Nodes**. The Workstation's ARCNet controller resides on the System Interface PCB (00-879054) inside the WorkStation. There are two ARCNet nodes associated with this board. One provides the ARCNet connection for the Interconnect Cable that leads to the Uroview Subsystem, and the other one connects to the Workstation's rear panel Service port that is used with the Utility Suite software for calibration.
- **Table Generator Interface PCB**. As its name implies, the TGI interfaces Table and Generator devices to the ARCNet.
- **Collimator Interface PCB**. This PCB interfaces the Collimator Switch Matrix PCB and the Collimator to the ARCNet.
- **X-ray Control Interface PCB**. This PCB interfaces all equipment in the X-ray Control Console to the ARCNet.

Physically the ARCNet bus consists of a shielded, twisted wire pair of wires that connects to an RS-485 bus transceiver for each node. The twisted lines reverse polarity each time one of the devices on the bus transmits a bit. This type of signal is called differential, and is very useful in electrically noisy environments or when signals must travel long distances. The ARCNet is useful at distances up to 4000 feet.

Each line in the twisted pair RS-485 interface alternates between 0 and 5 Volts, so it is relatively easy to check for bus activity using an oscilloscope or a logic probe with a pulse catcher. RS-485 is half duplex, meaning that only one device can transmit at a time. ARCNet Firmware regulates bus communications and prevents data collisions. Each node tri-states (assumes a high-impedance state) when not transmitting so it doesn't interfere with the other devices on the bus. The characteristic impedance of the RS-485 interface is 60 ohms. The bus commonly terminates at each end into a 120-ohm resistor.

CANbus

The Table Generator Interface PCB is equipped with a Control Area Network (CAN) bus interface, which it needs to communicate with the GE X-ray Generator. This CANbus communications circuitry appears on page 3 of the Table/Generator schematic (00-881567).

The CANbus circuitry on the Table Generator PCB consists of a communications controller and a protocol controller, both of which appear on the schematic.

The 82527 serial communications controller is a highly integrated device for network implementations that uses the CAN 2.0 protocol. The CAN protocol uses a multi-master (contention based) bus configuration for transfer of "communication objects" between nodes of the network. This multi-master bus is also accomplishes CSMA/CR, or "Carrier Sense, Multiple Access, with Collision Resolution." The 82527 performs all serial communications functions such as transmission and reception of messages, message filtering, transmit search and interrupt search, with minimal interaction from the host microcontroller (CPU).

The 82C250 is the interface between the CAN protocol controller and the physical bus. The device provides differential transmit capability to the bus and differential receive capability to the CAN controller on the Table Generator Interface PCB.

Serial Interfaces

There are three principal types of serial interfaces in the Uroview subsystem. RS-485, the interface that supports the Uroview's ARCNet bus, was discussed under ARCNet. The following paragraphs discuss RS-232 and RS-422.

RS-232

Test equipment interfaces to the Uroview Subsystem are RS-232, as are the inputs to the Vacuum Fluorescent Displays (VFDs). RS-232 is the familiar serial interface associated with COM ports on personal computers. RS-232 interfaces on personal computers commonly support pointing devices, printers, and other peripherals.

A minimum RS-232 interface consists of three lines: transmit data (TxD), receive data (RxD), and a signal ground that is used by both TxD and RxD.

RS-232 voltages are bipolar, meaning that they are either positive or negative with respect to ground. Transmit and receive pins are at +12 Volts for a 0 bit (sometimes called a "space") and at –12 Volts for a 1 bit (sometimes called a "mark). This may seem backwards at first until you get used to it. The hardware flow control lines, however, behave conventionally. That its, +12 Volts on one of these lines is a 1 and –12 Volts is a 0.

Since RS-232 levels are affected by voltage drop along the data cable, the "official" RS-232 logic level is somewhat lower than 12 Volts in most installations. The longer the RS-232 data cable, the greater the voltage drop. Most of the time a voltage magnitude under 3 volts is too low for reliable communication, and magnitudes higher than that can be reliably detected as a 1 or 0 depending on their polarity. This limits the practical range of an RS-232 connection to a hundred feet or so, and much less if the equipment operates at high data rates. This is why a lot of the RS-232 equipment you see has a short data cable of only a few feet.

CAUTION: *If you use test equipment designed for 3 to 5-Volt computer logic to check out logic levels on an RS-232 port, you may damage the test equipment.*

RS-422

RS-422 is a differential interface like RS-485 with similar voltage levels (0 and 5 Volts), similar speed, and similar distance capabilities. There are a few RS-422 interfaces in the Uroview. The interface between the Video Standards Converter and the Table Generator Interface is full duplex RS-422. You can see this interface on page 7 of the 2800 Interconnect diagram (00-881504). The Frame Sync signal from the OEC Workstation is unidirectional RS-422. It appears in grid D6 on page 6 of the Interconnect Diagram.

Other Signals

There are other differential and single-ended signals that communicate commands and data from, and provide information back to Subsystem controls. Please refer to the applicable section of this manual to find detailed information on these signals. For example, to find out more information about CCD camera control signals, refer to the Camera/Video Control chapter in this manual.

Functional Tests

The easiest way to verify correct operation of a communications interface is to determine if equipment that uses that interface works correctly. The following tests are based on that idea.

ARCNet Test

Follow these steps to check the ARCNet for proper operation.

1. Verify that the Uroview Subsystem boots without displaying errors that relate to ARCNet communication.
2. After the Subsystem boots, press the HELP key on the OEC Workstation. Verify that the functional names of all five ARCNet nodes appear on the right Monitor screen under the heading SOFTWARE VERSION. These nodes are: (1), The Workstation (WS); (2), the X-ray Control Console (UXP); (3), the Table/Generator Interface (UTG); (4), the Service Node (SRV); and (5), Collimator Housing Control (UCP).
3. Verify that both Vacuum Fluorescent Displays (VFD) actively display Table position, technique, and other information as described in the Operator Manual.
4. Verify that all controls and indicators on the Collimator Control Panel function correctly.
5. Verify that all controls and indicators on the X-ray Control Console Function correctly.

CANBus Test

Follow these steps to check the CANbus for proper operation.

1. Verify that the Uroview Subsystem boots without displaying errors that relate to CANbus communication with the Generator.
2. Verify that the Vacuum Fluorescent Displays (VFD) actively display technique information when you operate the X-ray Generator.
3. Verify that you can control the X-ray Generator from the X-ray Control Console.
4. Verify that you can initiate X-rays from the X-ray Footswitch.

Serial Interface Tests

There are several synchronous and asynchronous serial signals in the Uroview Subsystem, each of which can be checked for proper operation without special test equipment. The following are a couple of examples.

Flat Panel Display RS-422 Communications Test

Verify that you can control the Flat Panel Display from the Collimator Housing Control or from the X-ray Footswitch. You should be able to invoke picture-in-picture and select all alternate video sources without difficulty. Refer to the Operator Manual if you need additional instructions on how to do that.

VFD RS-232 Input Test

Verify that the Vacuum Fluorescent Displays each display Table position, technique, and other data as described in the operator manual. Make sure that there is no garbled text, and that there are no dim or burned out segments on either VFD.

Testing Another Serial Interface

Check the function supported by the interface. For example, if you want to make sure the synchronous interface that supports the Table Hand Control works, just check the operation of each button on the control. If the table responds as it should, you can safely assume that the interface is OK.

Fault Isolation

Use the following table to troubleshoot problems related to Uroview 2800 Subsystem communication. The table provides a sampling of possible problems and is not a comprehensive list of all possible communication problems.

Problem	Possible Cause	Corrective Action
One or more ARCNet nodes does not appear under the SOFTWARE VERSION heading on the Workstation monitor when you press the Help key on the Workstation	Device unplugged	Inspect and correct as necessary.
	Device not receiving power	Inspect and correct as necessary.
	Damaged device connector or cable.	Inspect and correct as necessary.
	PCB that generates the ARCNet node is damaged or faulty.	Inspect the PCB for damage or loose connectors, and correct as necessary.
Flat panel Display has video but does not respond to commands you initiate from the Collimator Housing Control or from the X-ray footswitch.	Faulty Video Standards Converter PCB	Refer to Replacement chapter for access details. Inspect for damaged or loose connections. Replace if necessary.
	Faulty Table Generator Interface PCB	Refer to Replacement chapter for details. Inspect for damaged or loose connections. Replace if necessary.
Flat panel Display has no video and does not respond to commands from the Collimator Housing Control or from the X-ray footswitch.	Faulty Flat Panel Display or interconnecting cable.	Inspect and replace if necessary.
	Faulty Flat Panel Display Power Supply	Inspect and replace if necessary.
	Faulty Video Standards Converter	Refer to Replacement chapter for access details. Inspect for damaged or loose connections. Replace if necessary

Problem	Possible Cause	Corrective Action
GE Generator does not respond to Fluoro commands from the X-ray Control Console or Footswitch	Faulty XRC or Footswitch	Try using the alternate control.
	Faulty Table Generator Interface PCB	Inspect for damage, loose connectors, etc. If necessary, replace the TGI
	Generator difficulties	Refer to X-ray & ABS chapter for troubleshooting help.

Adjustments

There are no adjustments associated with the electrical interfaces discussed in this chapter.

Miscellaneous

Not applicable.